

Computer algebra guide: Updates

Introduction

The version of Maxima currently recommended by the University, and available at learn1.open.ac.uk/site/maxima, is more recent than that used to produce the printed *Computer algebra guide*.

This document highlights the main differences you may experience when using the current version of Maxima, and incorporates any known errata to the printed guide.

Please read this document in conjunction with the printed *Computer algebra guide*.

Note that numerical results obtained using different versions of Maxima may differ slightly in the 15th or 16th significant figure.

1 Installing Maxima

Page 7, revised Figure 2

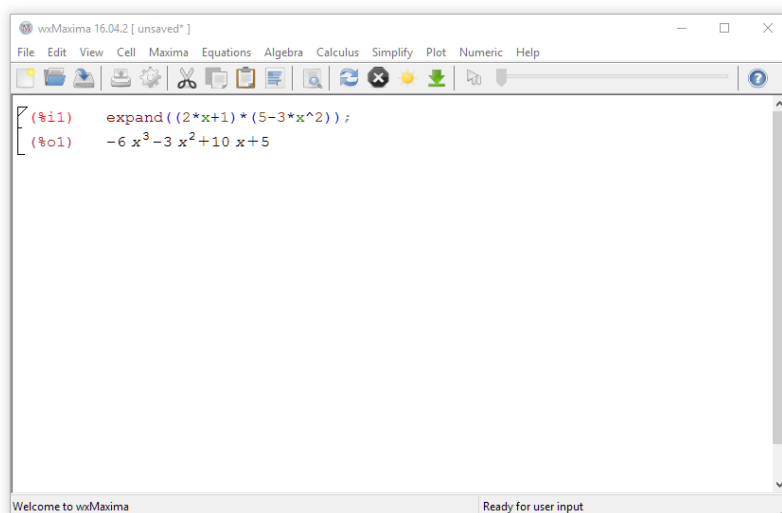


Figure 2 The wxMaxima interface

2 Getting started with Maxima and wxMaxima

Page 10, revised Figure 4 and following text

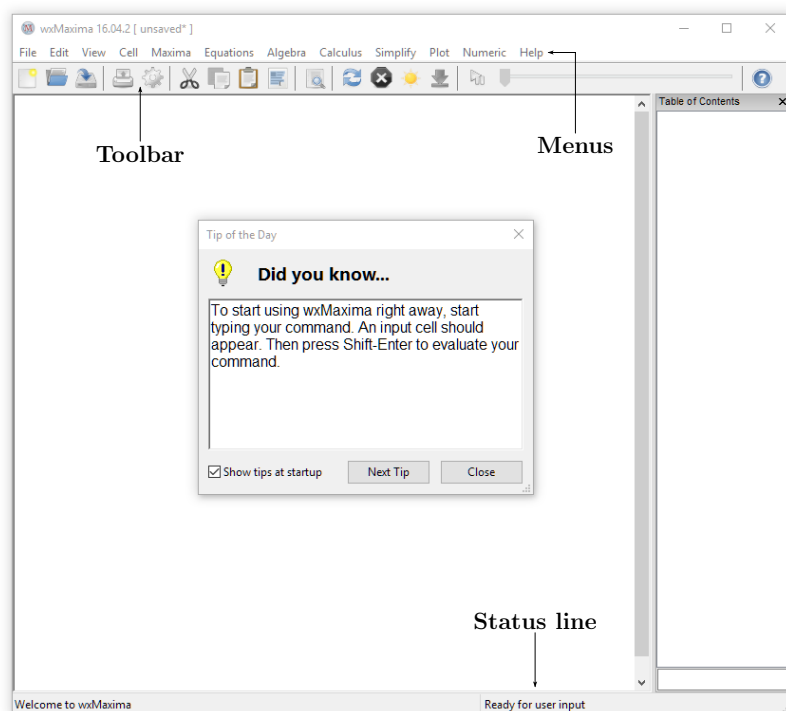


Figure 4 The initial wxMaxima window

When the software first starts, a secondary window showing the ‘Tip of the Day’ is also displayed. You can close it by clicking the ‘Close’ button. If you want to prevent this window from appearing the next time you start wxMaxima, click the box in its bottom left-hand corner, so that it is no longer ticked, before clicking ‘Close’. (You can always reinstate these messages at any time by selecting **Show tips** from the **Help** menu.)

Along the top of the main window (or along the top of the screen in the case of an Apple Mac) is a list of menu names, including the **File** menu which allows you to save or print your work and re-open previously saved sessions (there is more on this later). You can also close the software from the **File** menu by selecting **Exit**. (On an Apple Mac you can do this by selecting **Quit wxMaxima** from the **wxMaxima** menu.)

In Figure 4, a row of icons known as the **toolbar** is shown below the row of menu names. This is displayed only if **Main Toolbar** is selected in the **View** menu. The icons provide shortcuts to commonly-used functions.

The **View** menu also allows you to display palettes of commonly used commands. You can use these palettes as an alternative to typing some of the commands given in this guide.

Also shown in Figure 4 is the **Table of Contents**. This shows the names of any sections or subsections that you may add to your worksheet (see Subsection 2.6). You may want to close the Table of Contents, by clicking the cross near its top right-hand corner.

At the bottom right-hand corner of the wxMaxima window is a message that indicates the current status of the Maxima system. When Maxima is waiting for instructions from

you this reads ‘Ready for user input’. Other possible messages include ‘Maxima is calculating’, or ‘Reading Maxima output’.

Page 11, Computer activity 3: Additional text for end of box following point 2.

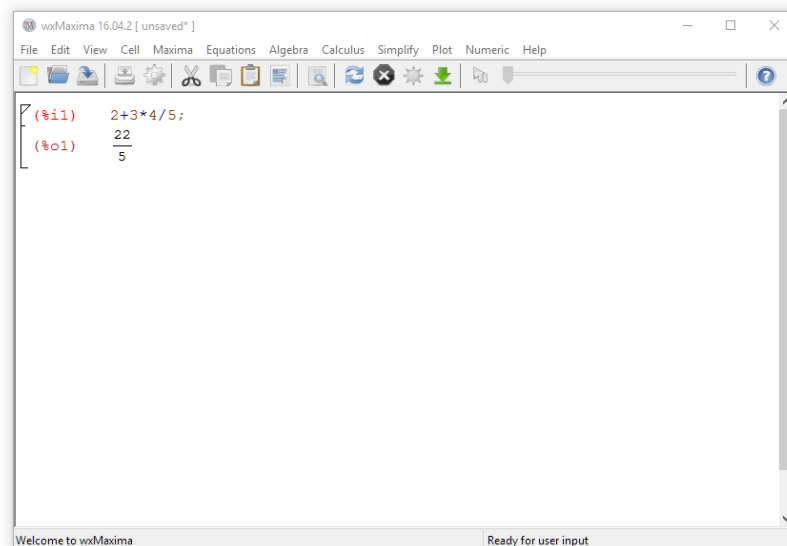
As you type, the colour of the text changes to highlight the different elements of your expression: numbers are coloured differently to the operations. This colouring will not generally be shown in the input given in this guide, except for in some of the screen images.

Page 11, Computer activity 3: Box following point 3.

Correction: In the first line of the box, “workspace” should read “worksheet”.

Page 12, Computer activity 3: Box

Updated figure



Addition text for end of box

Note also that input and output line numbers may not be coloured the same way as illustrated in this guide.

Page 13, revised Computer activity 5

Computer activity 5 Configuring wxMaxima

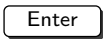
1. From the **Edit** menu, select **Configure** (or on an Apple Mac computer, from the **wxMaxima** menu, select **Preferences**).

Alternatively, click the following icon on the toolbar.



This opens the ‘wxMaxima configuration’ window.

2. Within the Configuration window, click the icon labelled “Worksheet” to access the worksheet settings, then tick the ‘Enter evaluates cells’ box by clicking it.

This changes the behaviour so that pressing  alone evaluates commands.

3. In the same list of settings, tick the ‘Open a cell when Maxima expects input’ box by clicking it.

This ensures that the input prompt is shown whenever Maxima is waiting for input.

4. Click on the icon labelled “Options” in the Configuration window, then tick the ‘Save sidebar status’ box by clicking it.

This ensures that your preferred configuration of the wxMaxima window, for example, hiding the Table of Contents, is retained between Maxima sessions.

5. Click ‘OK’ (or close the window if using an Apple Mac).

Page 16, replacement penultimate paragraph

Whenever you enter an opening bracket, the wxMaxima interface automatically adds a closing one for you. This behaviour can be turned off by unticking **Match parenthesis in text controls** in the “Worksheet” settings of the Configuration window. (See Computer activity 5 for how to open the Configuration window.)

Page 18, Computer activity 8(c)

The decimal form of the number may be displayed as

3.273390607896142 10^{150}

Page 20, revised Figure 7

```
(%i1) %pi+%pi/3+%e^2;
(%o1)  $\frac{4\pi}{3} + e^2$ 
-----
(%i2) float(%pi+%pi/3+%e^2);
(%o2) 11.57784630371704
```

Figure 7 The wxMaxima horizontal cursor

Page 22, Computer activity 12, Box following item (a)

Note that when assigning variables, Maxima precedes the output with either the output line number or the name of the variable being assigned a value. Which one is used is determined by whether or not ‘Show user-defined labels instead of (%oxx)’ is ticked in the ‘Worksheet’ settings of the Configuration window. In this guide, the output line numbers are shown.

Page 25, revised Figure 8



Figure 8 Adding text to wxMaxima worksheet

Page 26, bottom: Additional text

Whenever you add a Section or Subsection cell, a corresponding entry is added to the Table of Contents window. You can display this window by selecting **Table of Contents** from the **View** menu, or by pressing **Alt-Shift-T**, that is, by holding down the **Alt** and **Shift** keys while pressing **T**.

Page 27, Subsection 2.7 Saving and printing your work: Revised subsection

After working with Maxima you will probably want to save your calculations so that you can reuse or read them at a later date. You can do this in wxMaxima using the **Save** or **Save As** options from the **File** menu.

There are various different formats in which you can save your work.

It is recommended that you save your wxMaxima work as a wxMaxima document, with the **.wxm** file type. This saves all your input but not any calculated output. You have to recalculate the output when you re-open the file, as demonstrated in Computer activity 16.

The alternative file types available are as follows.

- A wxMaxima document, with the **.wxmx** file type. This saves all the input and the output.
Note that when you load a worksheet previously saved as a *.wxmx file, although both the saved input and output is displayed, the input has not been evaluated by Maxima, so you cannot immediately use any results of the worksheet in new calculations. To re-evaluate the worksheet, and so recalculate all the results it contains, select **Evaluate All Visible Cells** from the **Cell** menu, or press **Ctrl-R**.
- A **Maxima batch file**, with the **.mac** file type. This is for more experienced users of Maxima.

You can open a saved wxMaxima worksheet by using the **Open** option from the **File** menu, or by double clicking on the saved file on your computer.

Computer activity 16 Saving your work

Save your current worksheet then reload it, by following these steps.

- (a) Select **Save As** from the **File** menu.
- (b) In the window that appears:
 - (i) Choose the folder in which to save your work. You might like to save it in the folder that you created in Computer activity 1.
 - (ii) Choose a name for the file in which the worksheet will be saved.
 - (iii) Make sure the file is saved as a wxMaxima document with the **.wxm** file extension.
 - (iv) Click 'Save'.
- (c) Close wxMaxima, by selecting **Exit** from the **File** menu, or typing **Ctrl-Q**, or clicking the small 'x' at the top right of the window.
(On a Mac select **Quit wxMaxima** from the **wxMaxima** menu or hold down the **command** key while pressing **Q**.)
- (d) Open your worksheet in wxMaxima again, either by
 - (i) double clicking on the file you just saved, or
 - (ii) following the steps below:
 - Start wxMaxima again.
 - Select **Open** from the **File** menu. Maxima will ask if you want to save your just opened, blank worksheet. Click 'No'.

- Find the file containing your work and click ‘Open’.
- (e) Re-evaluate the worksheet by selecting **Evaluate All Visible Cells** from the **Cell** menu or pressing **Ctrl-R**.

The calculations in the worksheet are evaluated and results displayed.

You can print a wxMaxima worksheet by selecting **Print** from the **File** menu.

Alternatively, you can obtain an image of the entire wxMaxima window by taking a ‘screenshot’. To do this on a Microsoft Windows computer, first click on the wxMaxima window, then press **Alt-PrintScreen** (that is, hold down the **Alt** keyboard key while pressing the **PrintScreen** key, which may be labelled **PrtScr**, **Prt Scrn** or something similar). This stores the image, which you can then paste into a suitable application. If you are using Windows Vista, Windows 7, 8 or 10 you might like to use the ‘Snipping Tool’, available by typing ‘snip’ into the Start menu. To take a screenshot on an Apple Mac computer, press **Cmd-Ctrl-Shift-4** (that is, hold down the **command**, **ctrl** and **↑** keyboard keys while pressing the **4** key). Next press the space bar, move the camera pointer over the wxMaxima window and click. This stores the image, which you can then paste into a suitable application. You may also like to use the Grab application from the Utilities folder.

You can also paste individual output lines (or parts of output lines) from the worksheet into, for example, word-processed documents. Select the part of the output that you wish to paste, then from the menu obtained by clicking the right mouse button, select one of the following options.

- **Copy** – This copies the Maxima syntax for the selection. It can be useful if you wish to use the Maxima syntax in another document, or use the copied output as input to another Maxima command.
- **Copy as Image** – This copies the selection as an image that can be pasted into another document.
- **Copy as MathML** – This copies the selection as MathML, which is an international standard for the representation of mathematics. The MathML can be pasted into, for example, versions of Word from 2007 onwards, when it will be pasted as mathematics that can be edited using the ribbon maths editor. It can also be imported into LibreOffice documents, by, within LibreOffice, first creating a maths object using the **Insert > Object > Formula** menu options, then importing using **Tools > Import MathML from Clipboard**.
- **Copy as LaTeX** – This copies a $\text{\LaTeX}$ representation of the selection that can be pasted into a source file of the $\text{\LaTeX}$ mathematical typesetting system.

Whole cells can also be cut and pasted using the above options, by selecting the cell marker before clicking the right mouse button. However, when doing this, the $\text{\LaTeX}$ source contains a significant amount of formatting information that you may not require, and the MathML option for a whole cell does not work in the version of wxMaxima current at the time of writing.

The whole worksheet can also be exported as an html document (a web page) or as $\text{\LaTeX}$ source code by selecting **Export** from the **File** menu. (Currently, these exports

are not perfect representations of the worksheet.)

Page 29, revised Figure 9

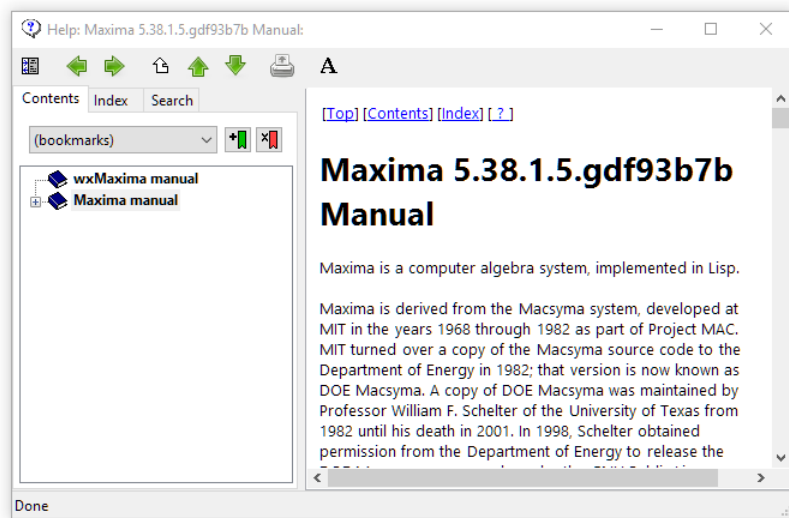


Figure 9 The Maxima help system

7 Plotting circles

Page 56, bottom

In the penultimate paragraph, the option

```
[gnuplot_preamble, "set size ratio -1"]
```

to plot graphs with equal axes should be replaced by

```
same_xy
```

The final paragraph can be ignored.

Page 57, Computer activity 38

The command to be entered is

```
wximplicit_plot(x^2+y^2=1, [x,-2,2], [y,-2,2], same_xy);
```


Page 57, line following Computer activity 38

This should read “Including the `same_xy` argument in the `wximplicit_plot` command can be tiresome...”

Page 57, paragraph above Computer activity 39

This paragraph can be ignored.

Page 57, Computer activity 39(a)

The command to be entered is

```
set_plot_option(same_xy);
```

Page 57, Additional text to follow Computer activity 39

The command needed to resume the default plotting behaviour is

```
set_plot_option([same_xy,false]);
```

Page 59: Revised tables**Graph plotting options**

Option	Argument	Example
Specific equal scale axes	<code>same_xy</code>	<code>same_xy</code>

Setting default plotting options

Operation	Command	Example
Set the default plotting options	<code>set_plot_option(option)</code>	<code>set_plot_option(same_xy)</code>

9 Integration

Page 67, Computer activity 48(a)(ii)

The question asked by Maxima may be

Is n equal to -1 ?

rather than

Is $n+1$ zero or nonzero?

In which case the answer should be `y` (for yes) or `n` (for no).

Correction: In the first boxed text, $\log|x| + c$ should read $\ln|x| + c$.

13 Complex numbers

Page 89, Computer activity 65

Part (b) should read

Use Maxima to find the moduli and principal arguments of $c*d$ and c/d .

not

Use Maxima to find the moduli and principal values of $c*d$ and c/d .

Maxima accessibility guide

Page 94, Changing wxMaxima colours and fonts

The icon to open the configuration window is now



Page 95, Using a screen magnifier or screenreader

The Zoom In and Zoom Out commands are now on the View menu, not the Edit menu.

Computer methods for CAS Activities in Books A–D

Page 116, Computer solution to Unit 5, Activity 17

Use the option

```
same_xy
```

rather than

```
[gnuplot_preamble, "set size ratio -1"]
```

to plot the graph with equal axes.

Solutions to Computer activities

Page 140, Solution to Computer activity 30(a)

The last closing parenthesis before the semi-colon should be deleted.

Page 151, Solution to Computer activity 44(b)

The output will now be formatted as

(%o2) $\text{df}(\mathbf{x}) := \frac{\text{d}}{\text{dx}} f(\mathbf{x})$